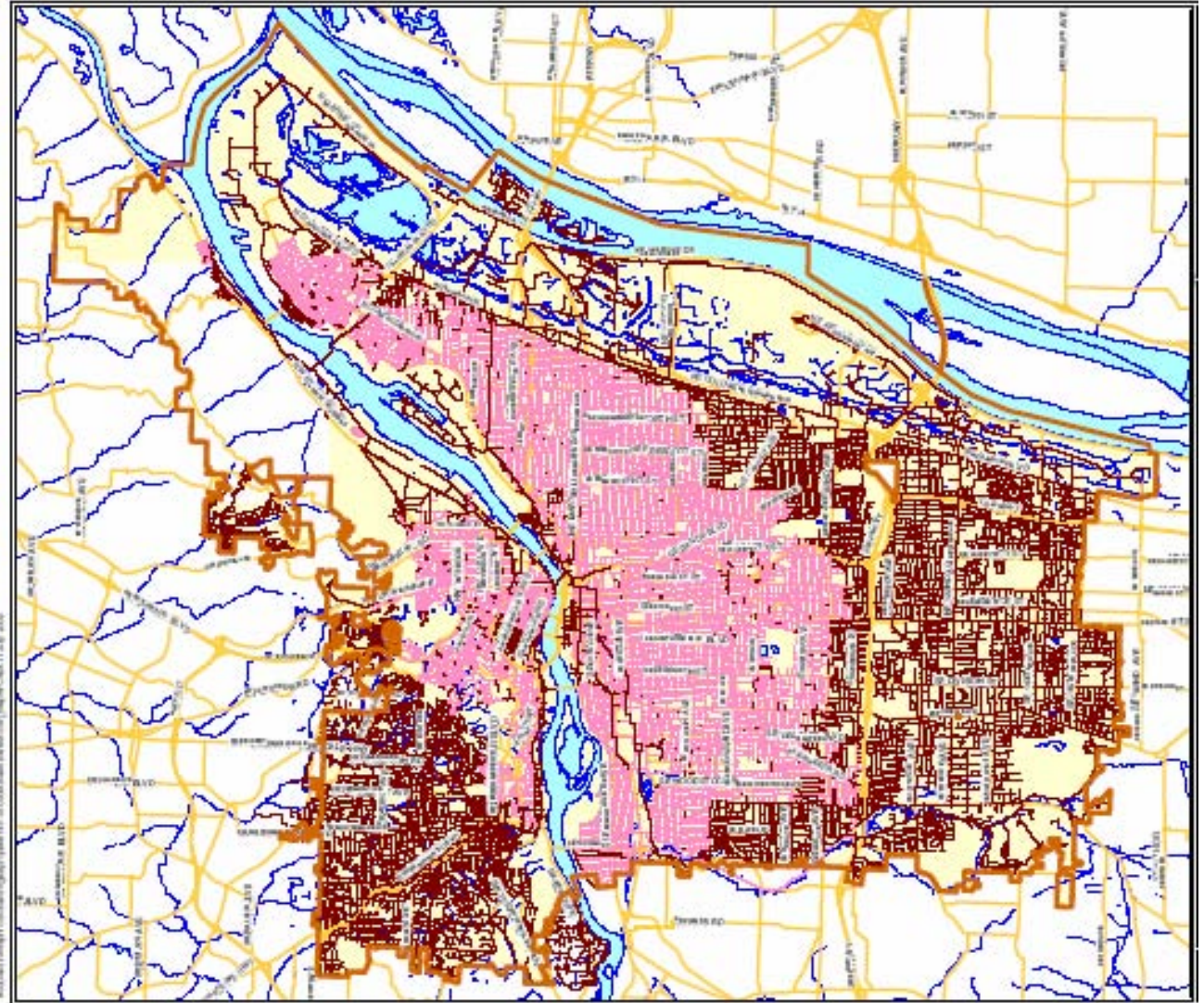


# Using Market Forces to Implement Sustainable Stormwater Management

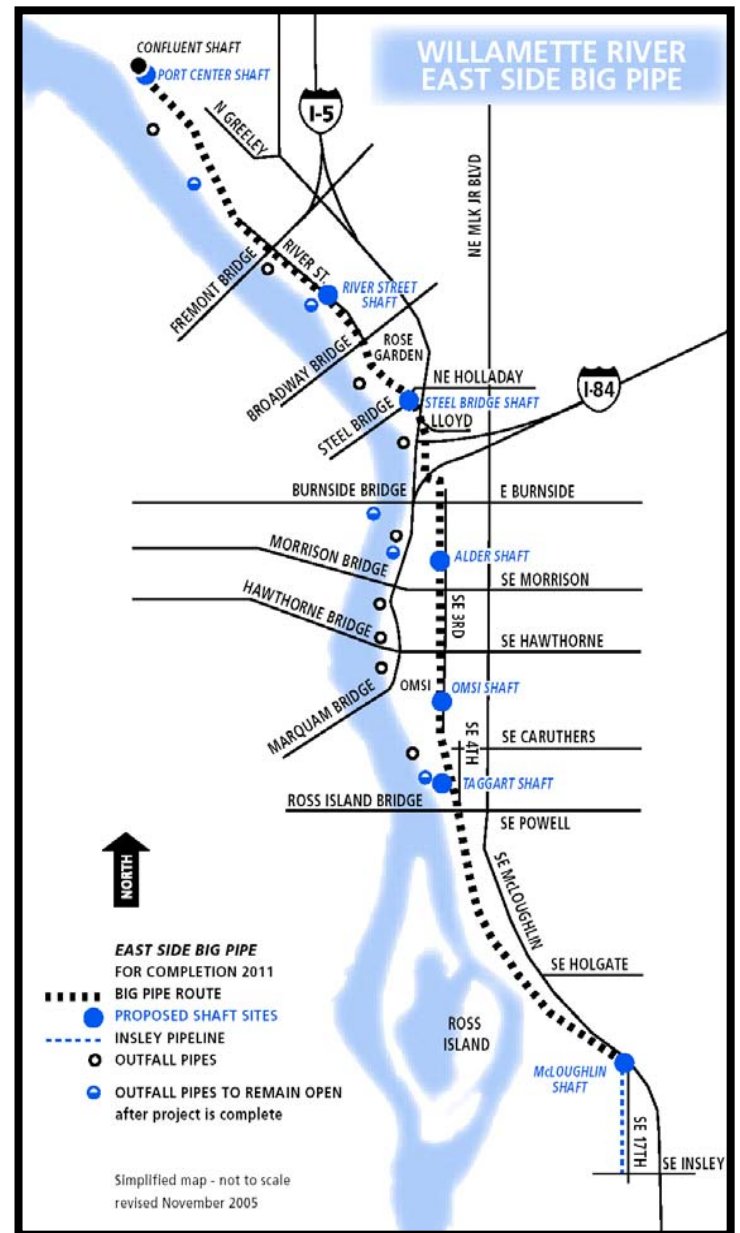
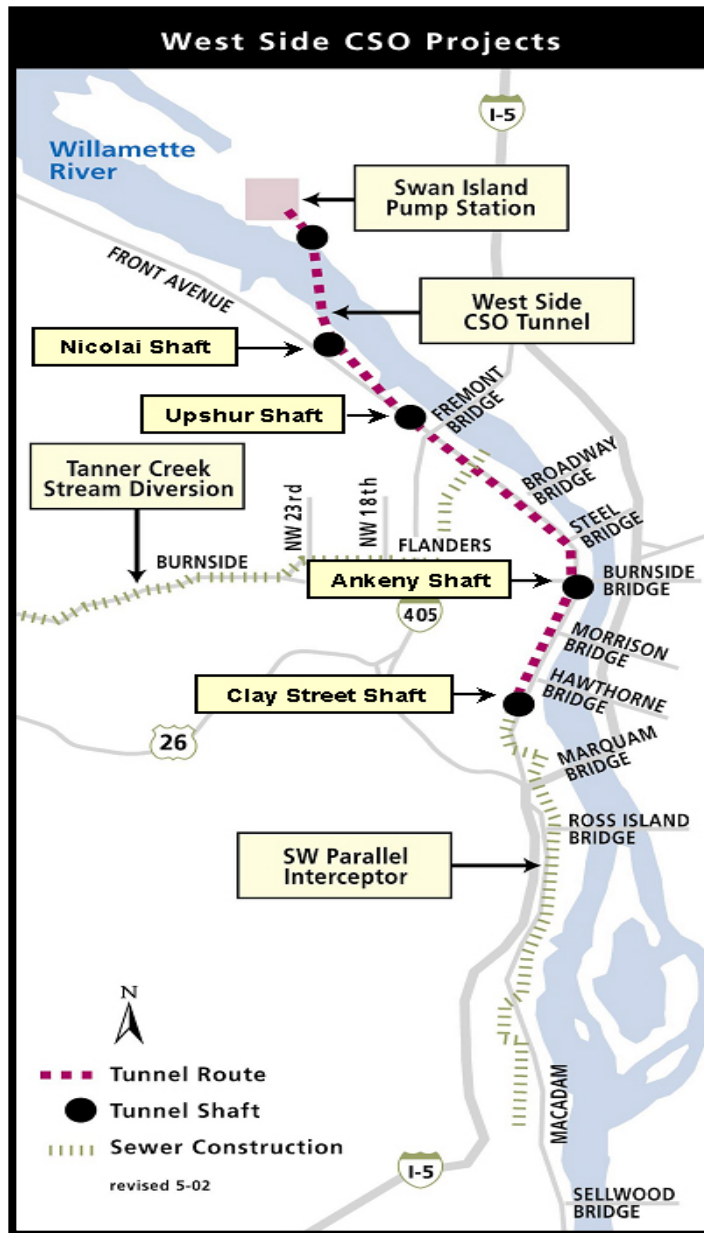


# Portland's Stormwater System

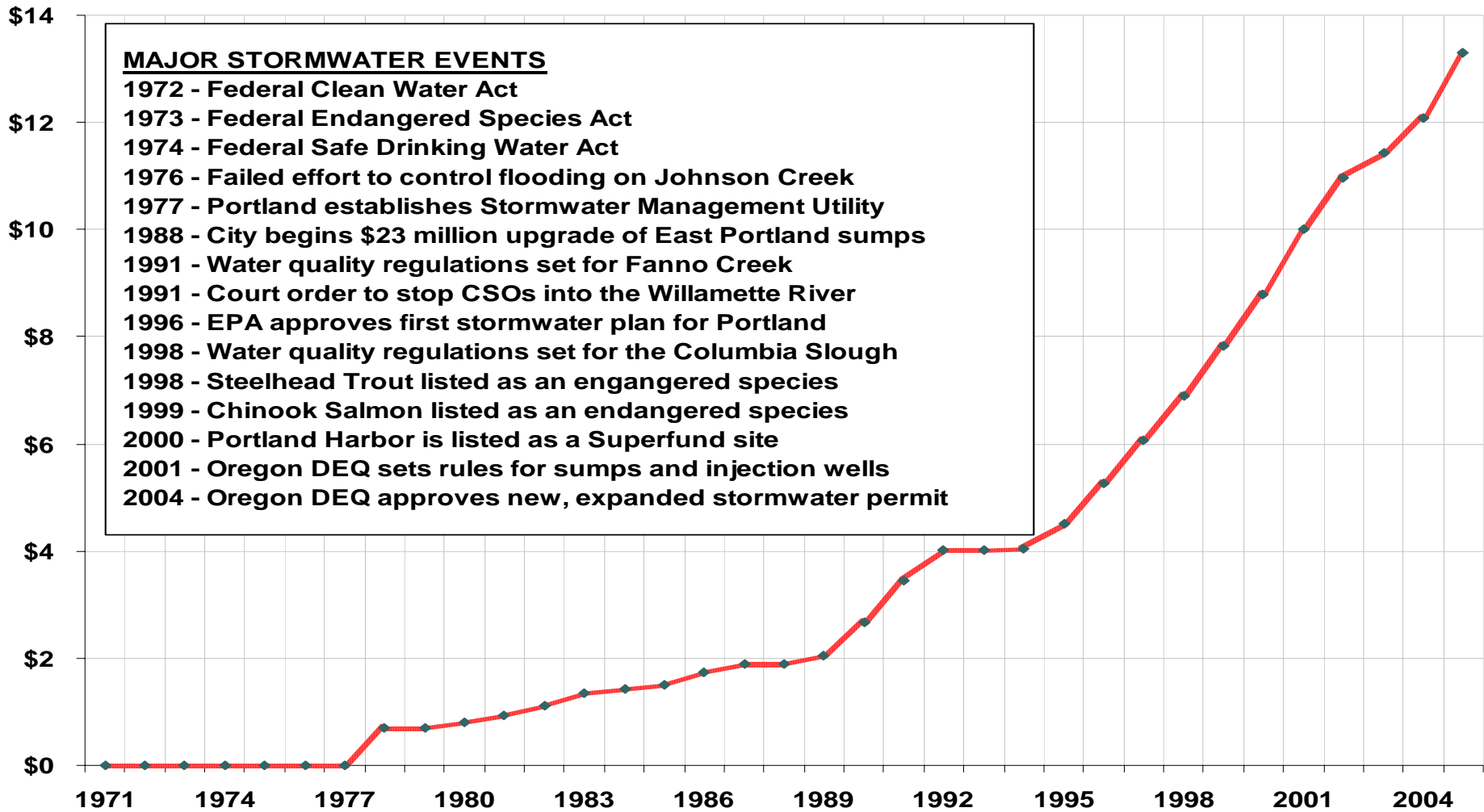
- 861 miles of combined sewers (pink)
- 932 miles of separated sanitary sewers (red)



# Portland's "Big Pipe" Isn't Big Enough



# Monthly Household Stormwater User Fee



# Project Overview

**Phase One  
Feasibility**

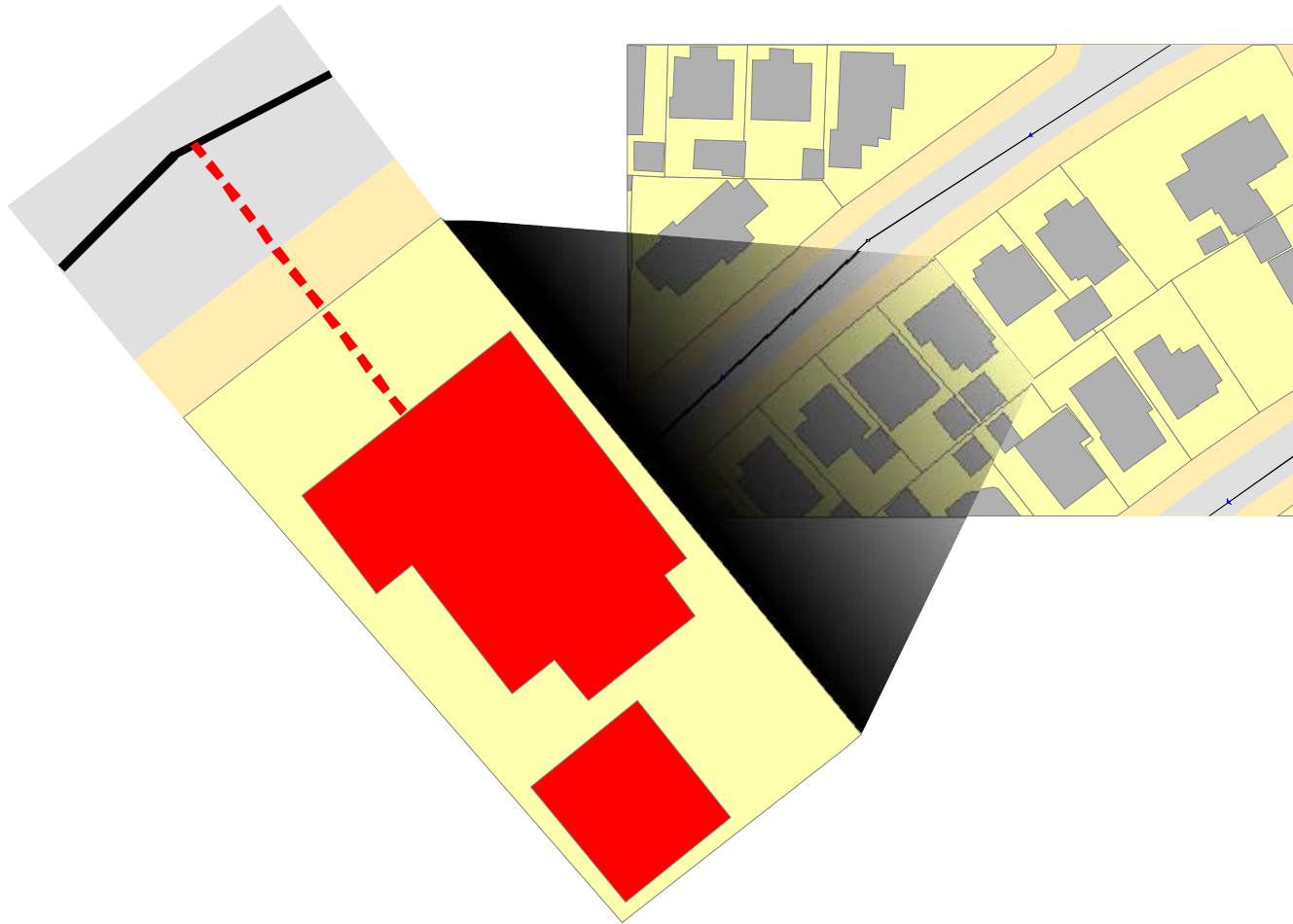
**Phase Two  
Market  
Analysis**

**Phase  
Three  
Pilot Test**

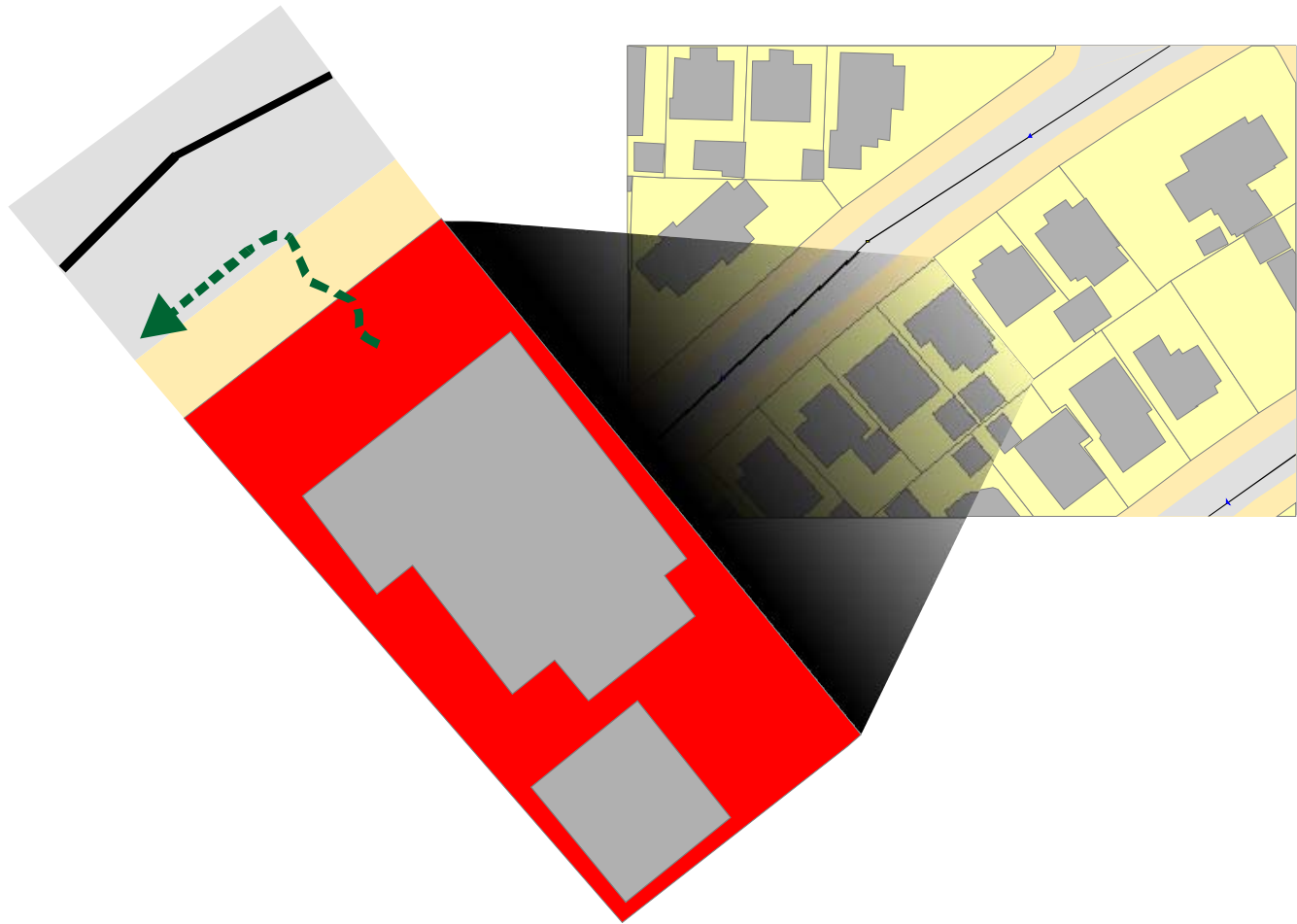
# Project Support Tools

- Explicit model for combined sewer systems
- GRID model for pollutant load estimation
- Stormwater BMP effectiveness evaluation
- Simplified scenario evaluation tool

# Directly Connected Subcatchments

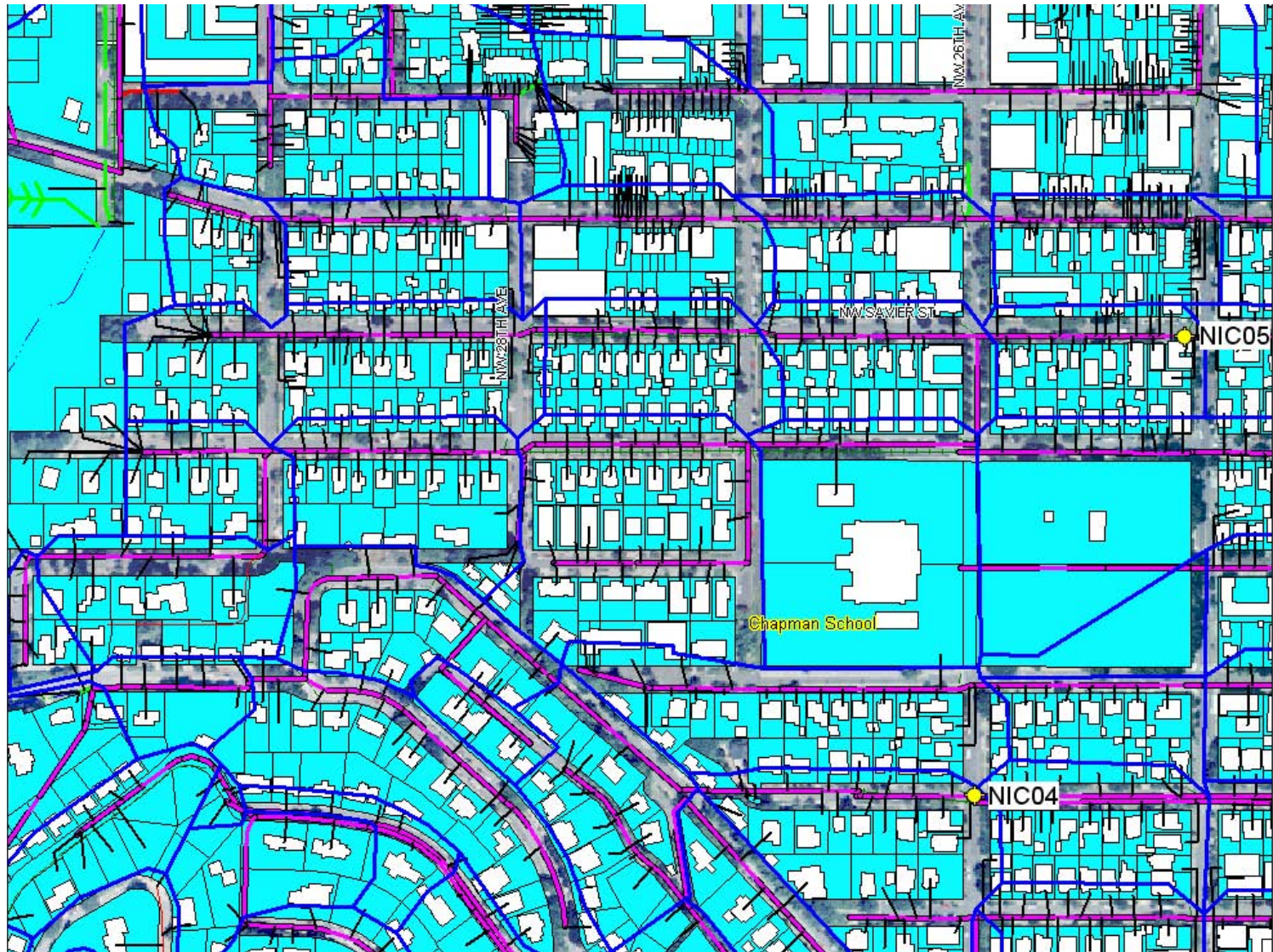


# Surface Water Subcatchments

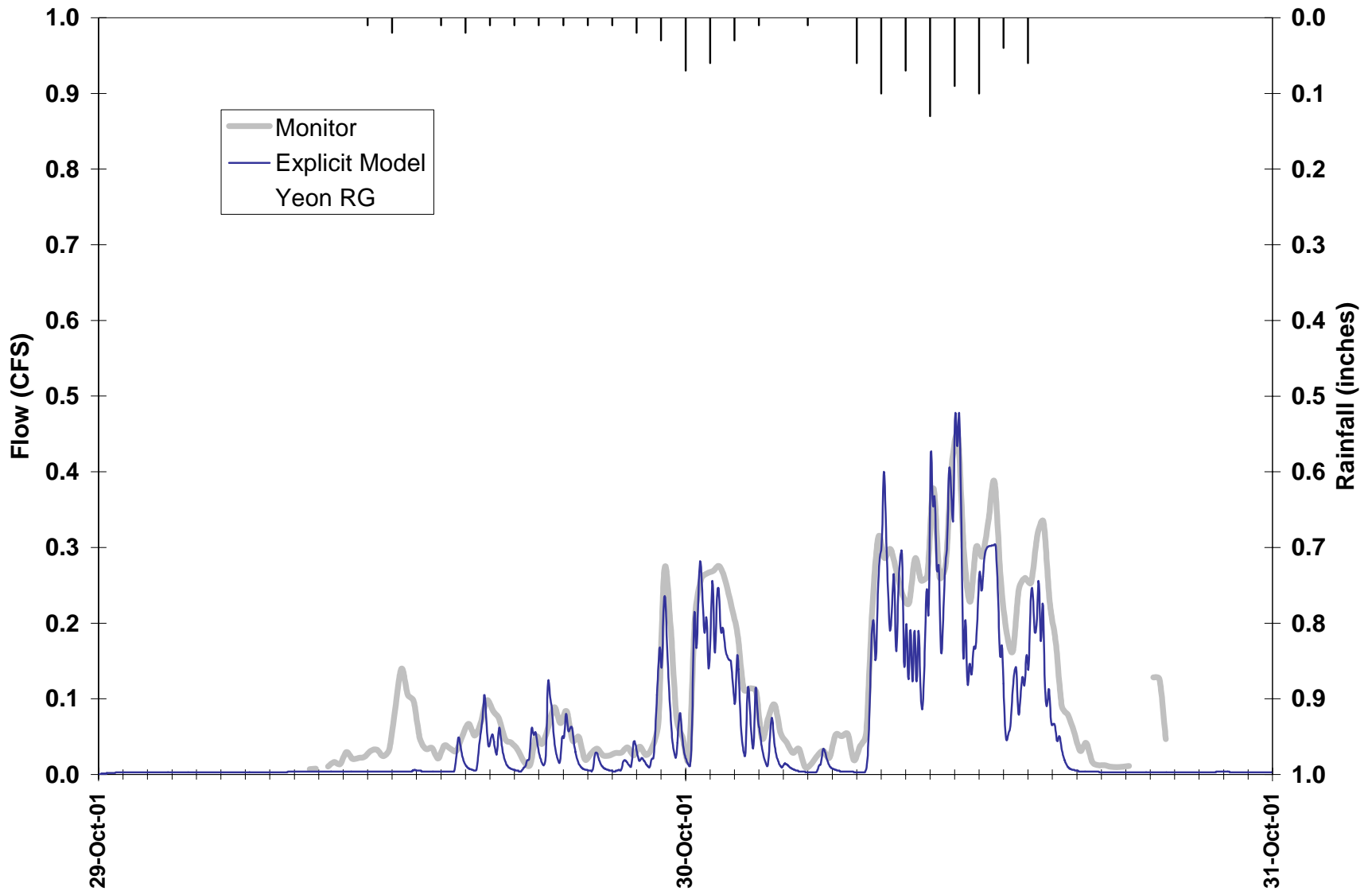




# Model Elements



# Calibration



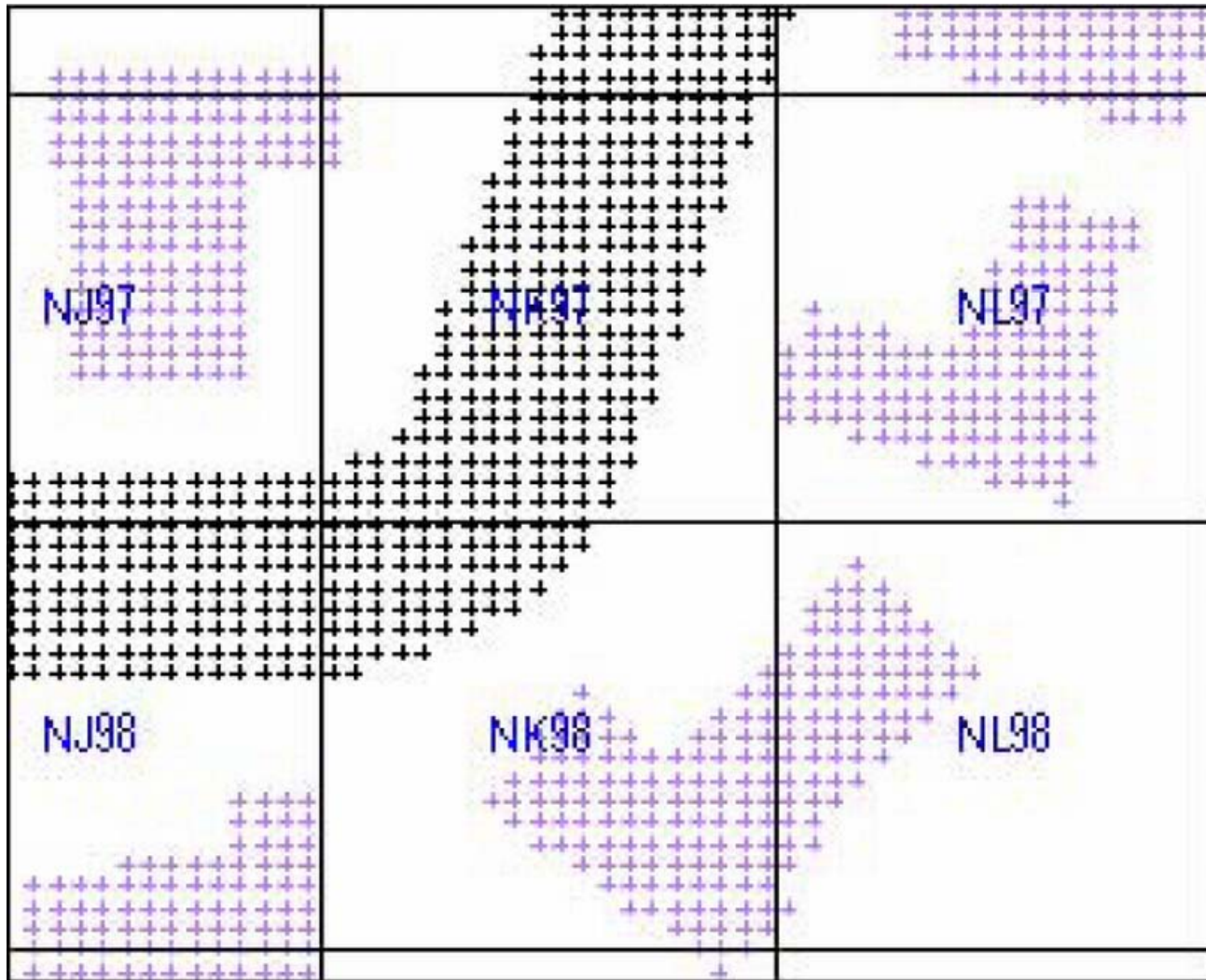
# Verification



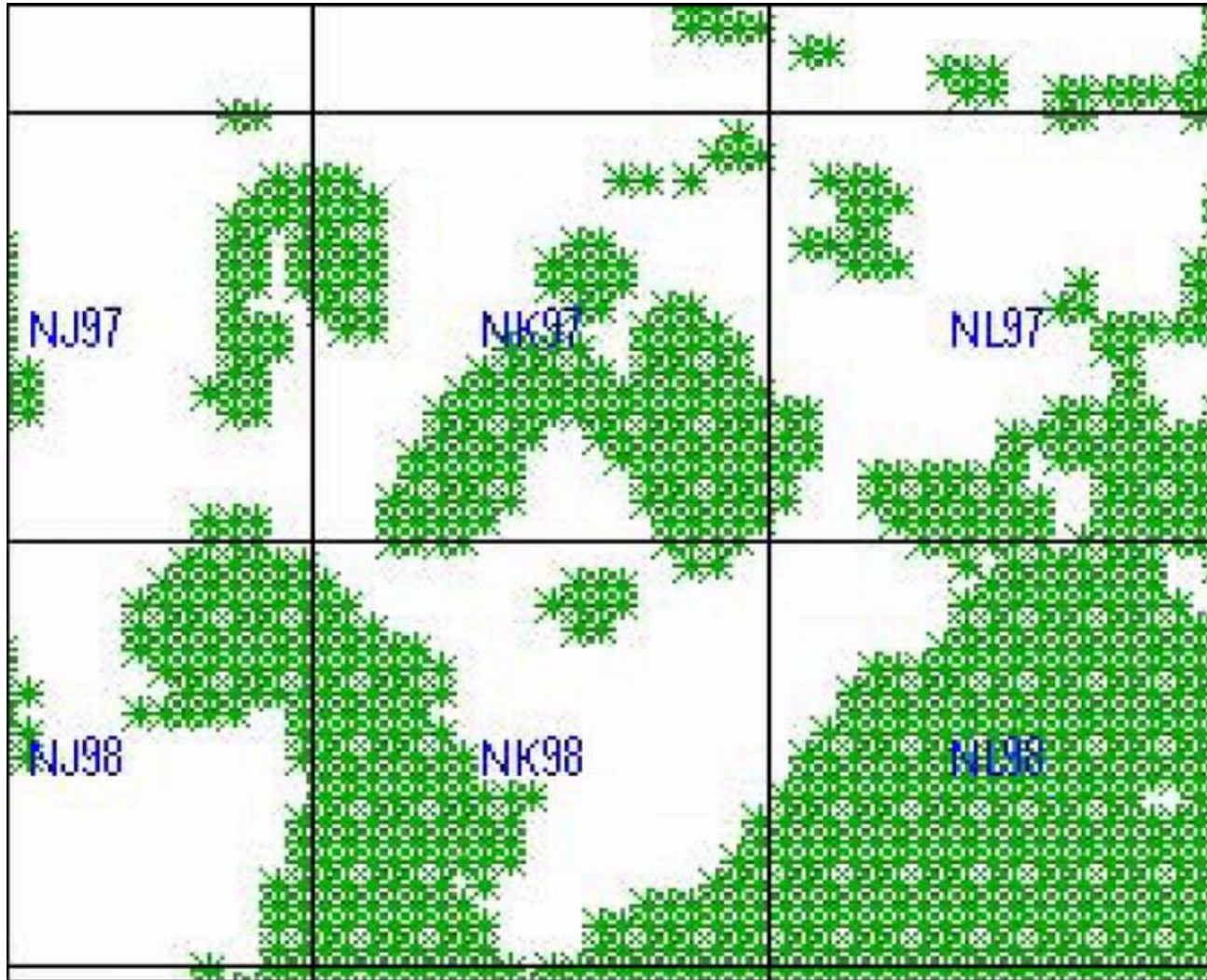
# Example Residential Area in 200 ft. Grids



# Impervious Surface



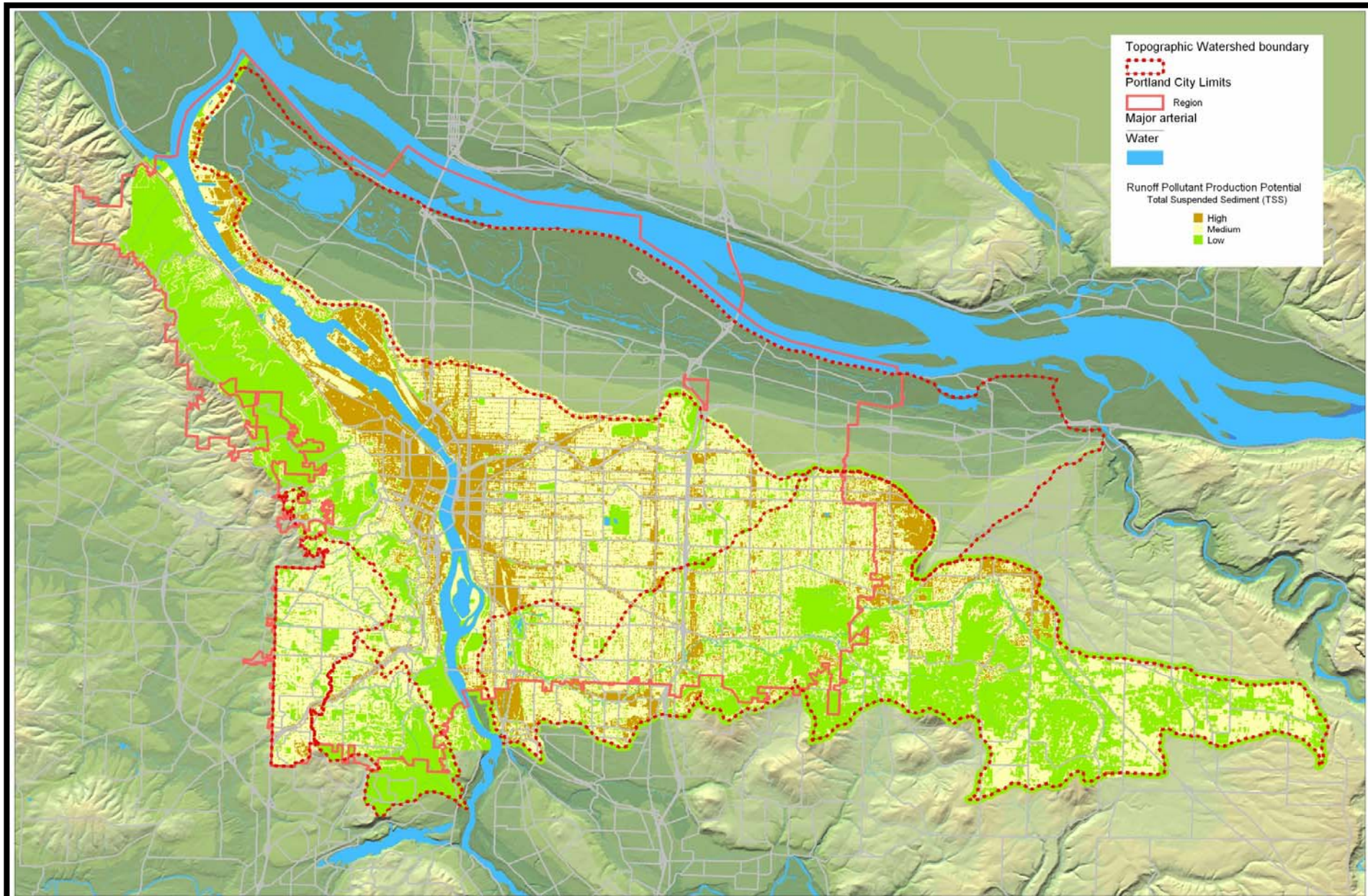
# Vegetative Cover



# Land Use



# GRID Model Output

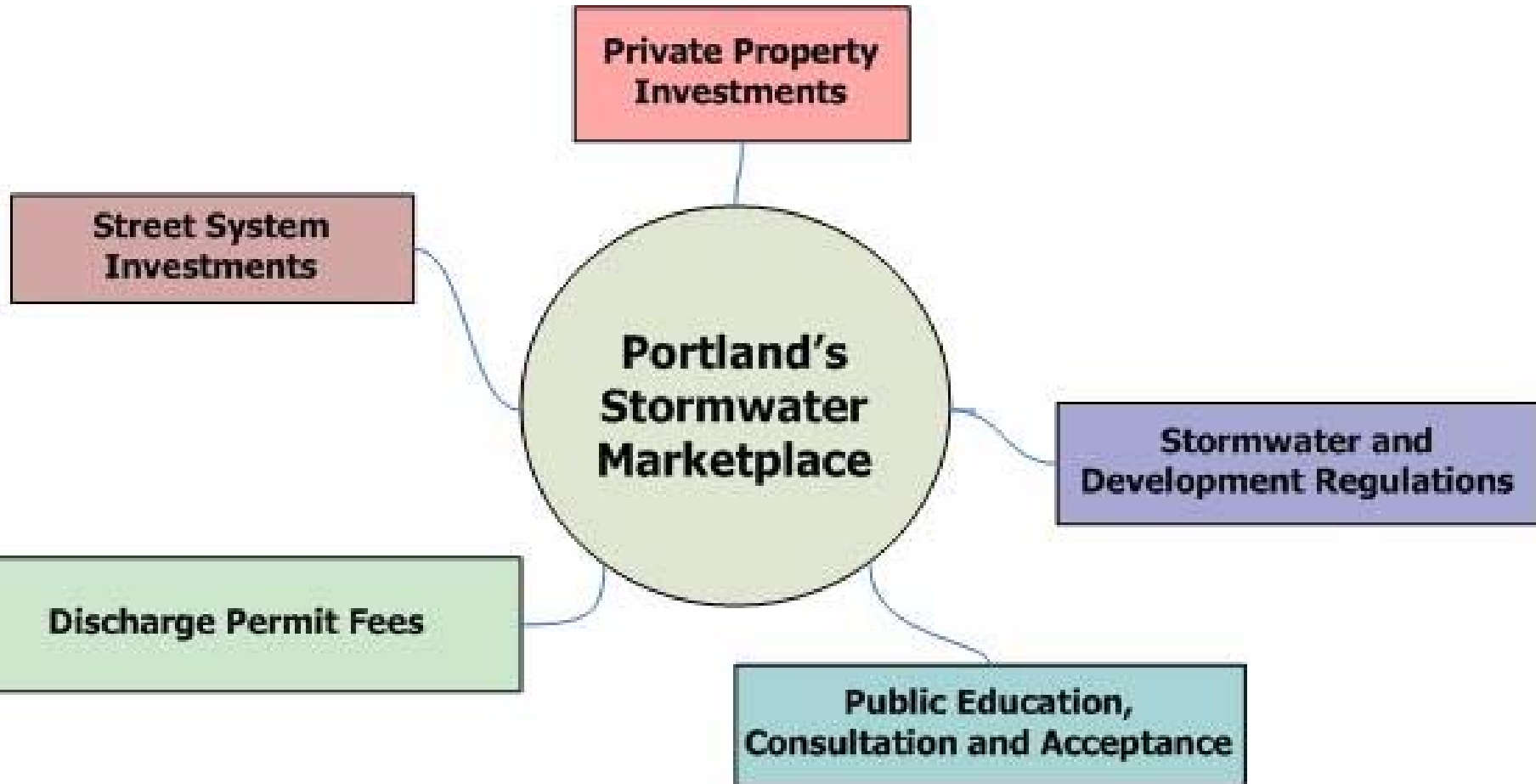


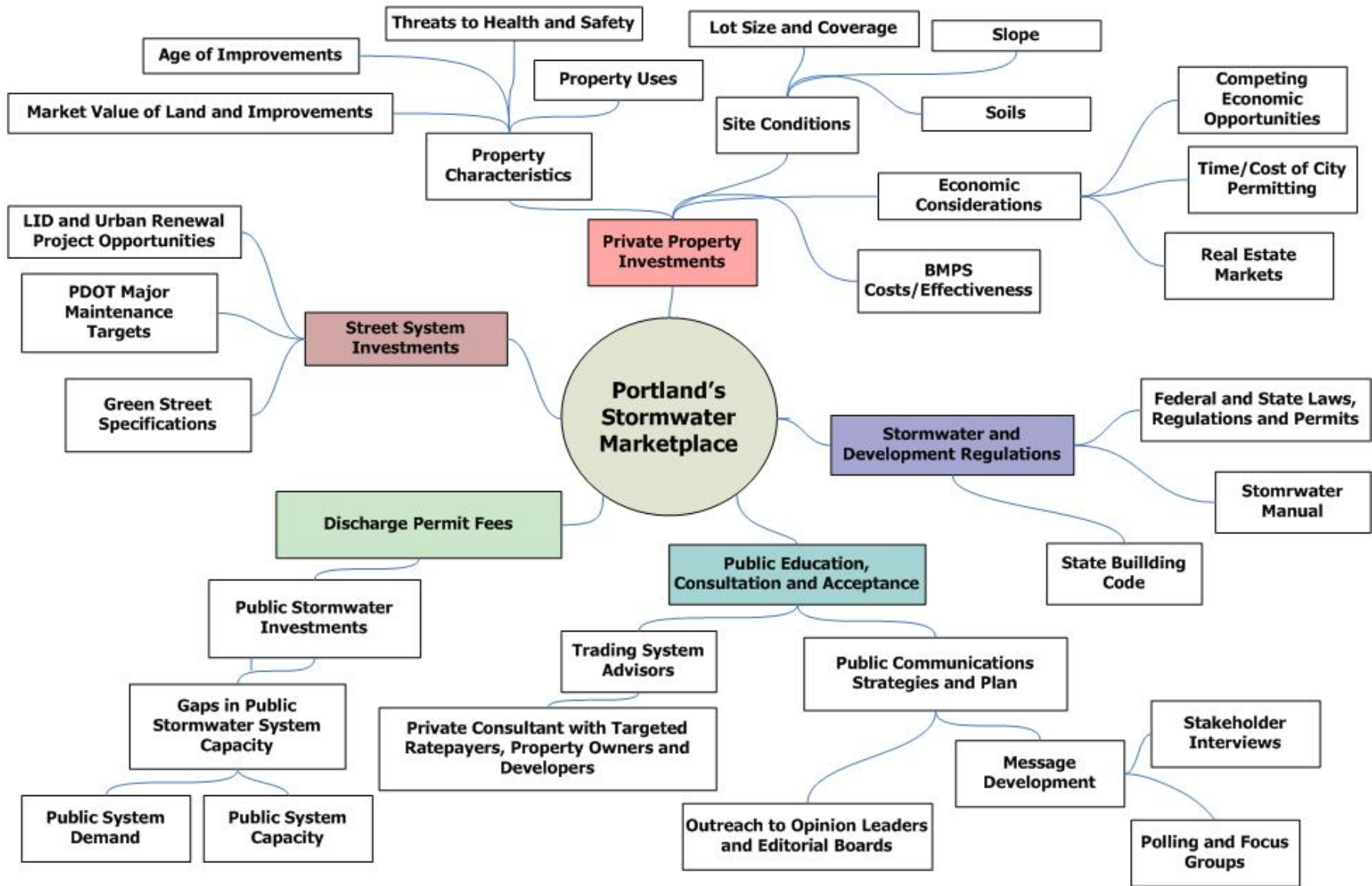


# BMP Effectiveness Evaluation

- Master spreadsheet by BMP – collected/derived information for all BMPs
  - Structural, non-structural, instream
  - Variety of pollutants and conditions
  - Information sources
  - Range of BMP effectiveness values and associated conditions at extremes
  - Default values
  - Qualifications
  - Certainty (H, M, L)

# Putting the Pieces Together





# IS A MARKET FEASIBLE?

**GLOBAL Assumptions**

- discount rate
- program costs (unusual BMPs)
- cost exchange for private
- rain event **toggle**

Re-development Reduction (as variable)

|           | Q  | TSS    |
|-----------|----|--------|
| Current   | 20 | 10,000 |
| target    | 15 | 7,000  |
| reduction | 5  | 3,000  |

## Simple Model

- X vol. red inputs
- X Based on 25 yr. event
- X capacity to analyze other events

| Bmp #  | 25yr. Event | 10yr. 2yr. |
|--------|-------------|------------|
| Bmp #1 | .08         |            |
| Bmp #2 | .05         |            |
| Bmp #3 | .003        |            |
| Bmp #4 | .017        |            |
| Bmp #5 | .100        |            |

Can build capacity, but will not use

Variables that can be changed as data improves

Emphasize: Impervious Acres Managed

N.W. Neighborhood : Base Case

## Scenario Planning

| Public                  | Constraint (acres) | A  | B    | C   | A*B  | A*C   | D           | TOTAL COST/ BMP |
|-------------------------|--------------------|----|------|-----|------|-------|-------------|-----------------|
| Capacity Exp.           |                    |    |      |     |      |       |             |                 |
| Demand Red              |                    |    |      |     |      |       |             |                 |
| Structural BMP #1       | 70                 | 25 |      |     |      |       |             |                 |
| Non-Structural BMP #2   | 30                 | 30 | .08  | 100 | 2.00 | 2,500 | \$ 2,000/ac | 50 K            |
| Structural BMP #3       | X                  | -  | .05  | 20  | 1.50 | 600   | \$ 1,000/ac | 30 K            |
| Non-Structural BMP #4   | X                  | 15 | .003 | 80  | .00  | -     | -           | 0               |
| Structural BMP #5       | 55                 |    | .017 | 70  | 1.50 | 600   | \$ 4,000/ac | 60 K            |
| Non-Structural BMP #6   | X                  |    | .10  | 40  |      |       |             |                 |
| <b>PRIVATE</b>          |                    |    |      |     |      |       |             |                 |
| <b>ACTUAL Reduction</b> |                    |    |      |     | 5    | 3,700 |             | 140 K           |

GRID + other

| Bmp #  | 25yr. Event | other events? |
|--------|-------------|---------------|
| Bmp #1 | 100         |               |
| Bmp #2 | 20          |               |
| Bmp #3 | 80          |               |
| Bmp #4 | 70          |               |
| Bmp #5 | 40          |               |

(max fusible acreage)

## BMP Constraint Matrix

|        | NW | MJ | L   |
|--------|----|----|-----|
| Bmp #1 | 70 | X  | 100 |
| Bmp #2 | 30 | 50 | 80  |
| Bmp #3 | X  | 25 | X   |
| Bmp #4 | X  | 47 | 120 |
| Bmp #5 | 55 | X  | X   |

cost incentives for private

## Scenario Creation

1. allows iteration of BMP combination
2. facilitates evaluation of private participation levels.
3. sensitivity of inputs easily determined
4. Base Case/mkt. checked to City assumptions

how is this bounded?  
how many acres can be managed by private.

Depending on cost incentives, 3 MKT cases examined @

| City Cost |            |
|-----------|------------|
| \$ 125K   | 25%        |
| \$ 180K   | 15%        |
| \$ 250K   | 5%         |
| Base Case | \$ 290K 0% |

reduction in flow from PRIVATE.

Control Variables

compare on COST + Qualitative criteria

- A) Ecosystem Services
- B) Biological Communities
- C) Habitat enhancement

Graphical & Summary OUTPUTS

# Next Steps...

- Evaluation Tool Development
  - Establish inputs (BMP constraints, performance, costs)
- Development of Base Case
  - Establish base case (current plan)
  - Input into and test evaluation tool (calibrate as needed)
- Development of Market Case
  - Establish market case
  - Input into evaluation tool
- Marketplace Strategies Evaluation
- Base Case and Market Case Comparison

# Surprising Results

- Challenge of documenting project costs
  - Site issues/perspectives create significant variation
- Challenge of documenting benefits
  - Site issues/treatment trains create significant variation
- Smaller scale analysis not always easier
  - Fewer planned BMPs reduced power of analysis
- More interest in markets than models
  - Quantification must precede policy but...



# How CNS Has Helped

- Allowed work to proceed
  - Work would not be done without the grant
- Increased visibility
  - Interest in/knowledge of ecosystem services increased
- Created collaboration among city bureaus
  - Engineers and planners working together to conduct analysis
- Provided networking opportunities
  - Contacts in Maryland, Ohio, Washington(s), Michigan



# Desired Feedback

- Help documenting/checking assumptions
  - How can we reduce the level of uncertainty?
- How best to create regulatory flexibility
  - How can we get regulatory agencies to experiment?
- How to simplify the presentation of the project
  - How can we make the project relevant to regular folks?
- Thoughts on greatest threats/risks of approach
  - What are we neglecting or forgetting?

